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Current Status of the Khulan (*Equus hemionus*) in the Trans-Altai Gobi

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Current status of the khulan (*Equus hemionus*) in the Trans-Altai Gobi

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Abstract

Since 1975 25 wildlife surveys have been conducted in the Trans-Altai Gobi. In this paper we summarize results from the last 11 surveys, conducted between October 2000 and April 2005, and discuss our findings together with results from previous surveys.

Key words: khulan, *Equus hemionus*, Trans-Altai Gobi, distribution

Introduction

Mongolia is the largest stronghold of the Asiatic Wild Ass worldwide and the Trans-Altai Gobi, also called Great Gobi A Strictly Protected Area (SPA), is an important refuge for the species in Mongolia. The khulan range in Mongolia basically covers the southern Gobi regions of the Khovd, Govi-Altai, Umnugovi and Dornogovi Aimag (SHIIREVDAMBA 1997). The historical distribution of this species covered a much larger area from northwestern to eastern Mongolia. However, since the 1960s the distribution range sharply declined and population number decreased because of human impacts (BANNIKOV 1954, 1975; SHIIREVDAMBA 1997). The khulan is included in the Mongolian Red Book (1987, 1997) and the World Red Book (1976). It is considered a rare species in Mongolia (LIST OF RARE SPECIES 2002) and is also listed in Appendix I of CITES (DULMATSEREN 2001) and Appendix II of CMS (CMS 2002). Hunting of khulan has been prohibited since 1953 by the Mongolian Hunting Law.

The famous Russian scientist BANNIKOV (1975) was the first to conduct work on khulan in the Trans-Altai Gobi and his book is still a key reference, not only for khulan, but for mammals in Mongolia in general (BANNIKOV 1954). Since then, the Russian-Mongolian joint biological expedition worked in this region and made multiple contributions on rare mammals, including the khulan (JIRNOV & ILINSKY 1985). Other researchers that focused on khulan in this region before the year 2000 were SOKOLOV et al. (1978), SUKHBAT et al. (1988), and READING et al. (1997). Several surveys done between 1982-1985 (JIRNOV & ILINSKY 1985) shows that khulan in the Trans-Altai Gobi mainly inhabit the northern and southern part of the park during winter-summer and summer-autumn.

Khulan in Trans-Altai Gobi permanently stay near open water points from March on and larger aggregations were documented near the Otgon and Maikhan bulag water point. Other groups stay in the vicinity of the Atas Mountain range, where snow cover lasts until April. A northward spring migration pattern was observed in the past and made some researchers believe that there may be two geographically isolated subpopulations (SUKHBAT & PUREVDORJ 1988). However, these local movements are more likely attributed to changes in precipitation and pasture conditions (JIRNOV & ILINSKY 1985; BANNIKOV, 1954). During their study from 1982 -1985 JIRNOV & ILINSKY (1985) also recorded these movements in the dry season and at times of high animal densities near water points (JIRNOV & ILINSKY, 1985).

Past population estimates used different sized areas for the potential khulan range in the Trans-Altai Gobi. READING et al. (2001), using aerial surveys, estimated khulan number for an area of 40,000 km². Researchers of the Institute of Biology estimate that the potential khulan range is much smaller, covering only 21700 km² (ASSESSMENT METHOD OF KHULAN 2003), whereas others believe it is somewhat intermediate and covers 39,500 km² (AMGALAN et al. 2002). The total area of the Great Gobi A SPA is 51,150 km², excluding areas used by herders in which khulans only appear on rare occasions. In the present paper we present findings of 11 surveys con-

ducted since 2000 and discuss them together with previous results. Main objective of our study was to 1) determine khulan distribution, and 2) estimate population number and density.

Materials and Methods

Surveys were conducted using a line transect approach. Wildlife was spotted from the driving vehicle by eye and by using binoculars. Extrapolation of numbers followed methods used and compared by DASH & GANBAT 1981 and ASSESSMENT METHOD OF KHULAN 2003 as:

Population estimate:

$$1. P = \sum \frac{s \cdot n \cdot m}{L \cdot K} \cdot d; \quad \text{and} \quad 2. Nt = \frac{N_s \cdot N_d}{LW_a};$$

Where s = estimated distribution area of khulan, n = number of group counted, m = average group size, L = transect length, K = transect width, and d = 2/3 (condition concerning coefficient) cannot be used if census covered more than 50% of all distribution area, and N_s=khulan distribution area calculation using an Arc View program based on locals and researchers interview, N_d = total animal counted in searched areas, L = transect length and W_a = average transect width.

Routes were opportunistically chosen, often being a by-product of other field work requirements. Travel routes and khulan positions were documented with a GPS.

Our results are based on 11 surveys conducted by various teams of changing composition, including several joint Mongolian-international teams (fig. 1).

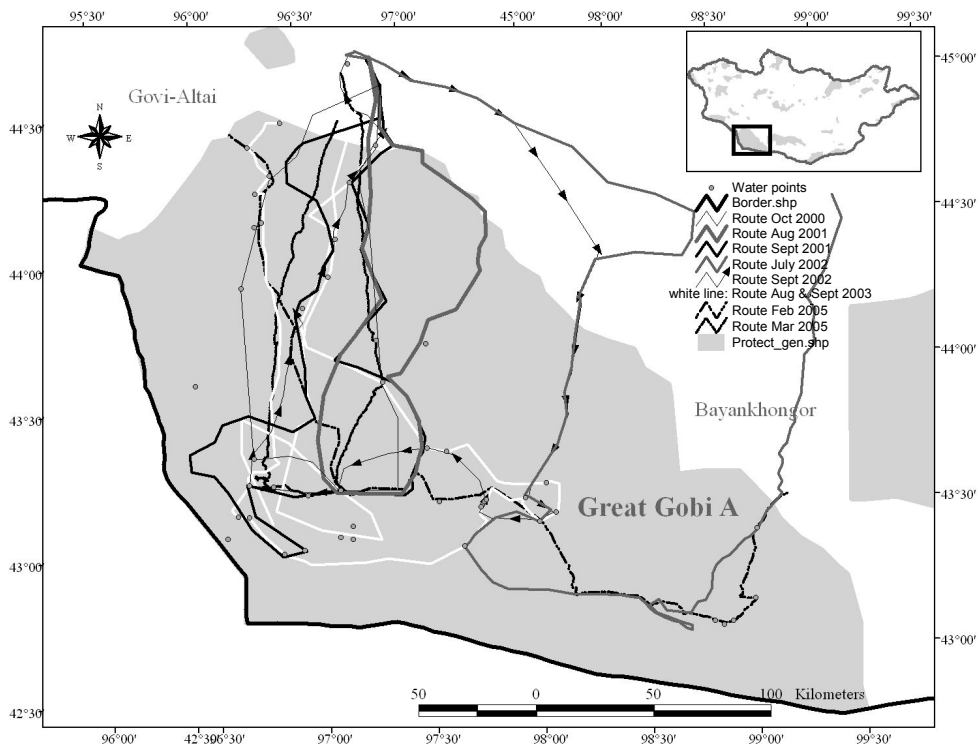


Fig. 1: Study routes in the Trans-Altai Gobi.

Previous methods (before 2000) employed were transect counts by vehicle or airplane, following pre-defined routes and counting animals on both sides up to a certain distance. Until 1990, population censuses were conducted for game animals to assess sustainable hunting quotas. Since 1990, the focus became more conservation orientated and surveys were also conducted to assess the population size and distribution range of rare animals.

Results

The surveys were conducted in: October 2000, June & July 2001, April 2001, September 2002, July 2002, August & September 2003, April 2004, August & September 2004, February 2005 and March 2005 (fig. 1). Distances travelled during each individual survey varied from 348 km to 2300 km and the number of khulan counted between 1 and 92 (table 1).

Table 1: Transect length and khulan encountered during 11 surveys conducted in the Trans-Altai Gobi between October 2000 and April 2005

Date	distance travelled (km)	khulans counted	groups counted	group size range	density estimated per 1,000 ha	total population estimated for 21,700 km ²
October 2000	627	13	5	1-5	0.01-0.02	30±6
April 2001	500	1	1	1	0.004	16.5±1
August 2001	927	17	10	1-5	0.02	57±11.5
September 2001	521	92	15	1-22	0.13	287±57
July 2002	400	1	1	1	0.003	16.3±3.2
September 2002	700	60	1	1-60	0.12	279±55.8
August/September 2003	1500	47	18	1-6	0.03-0.4	67.7±13.5* 141.7±28.3
April 2004	2000	60	10	1-7	0.03	78.1±15.6
August/September 2004	2300	43	12	1-18	0.03	67.6±13.5
February 2005	469	23	5	1-8	0.01	212.8±42.6
March/April 2005**	422	76	15	1-15	0.12	281±56.3

* estimated area of khulan concerned by authors (41 835 km²)

** by camel

The first survey was conducted in October 2000 over a total distance of 627 km. Assuming an ability to detect all khulans up to a distance of 4.5 km to the left and right of the transect route, we searched estimated 5,643 km² of the khulan range. We recorded 13 khulans in 5 groups with an average group size of 3. The population density was estimated at 0.01-0.02 animals/1,000 ha (ASSESSMENT METHOD OF KHULAN 2003).

In April 2001, we recorded 1 khulan in the Gantumryn sair valley, but none along a 500 km transect along Atas Mountain, Inges Mountain and the water points Bogts tsagaan ders, Khukh us and Baruun sharga. Assuming an observation distance of 2 km and covering about 2000 km² of khulan range. The density estimate was 0.005 animals/1,000 ha (ENKHBILEG et al. 2002).

At the end of July and the beginning of August 2001 a survey was conducted by the park staff along a 962 km route. Assuming an observation distance of 2 km, they covered about 3,848 km² of khulan range. On this survey 17 khulans in 10 groups were recorded. Herd size ranged from 1-5. Population density was estimated at 0.03 - 0.04 animals/1,000 ha (ASSESSMENT METHOD OF KHULAN 2003).

In September 2001 a survey was conducted along a 521 km route, covering an estimated 4,168 km² of khulan range (assuming a 4 km observation distance). In total 92 khulans in 15 groups were recorded. Herd size ranged from 1-22 animals with an average of 5.8 animals. The density estimate was 0.01 - 0.03 animals/1,000 ha (ASSESSMENT METHOD OF KHULAN 2003).

In July 2002, during a bird survey, we observed only 1 khulan along a 400 km route including Khyaryn gun, Zam Bilgekh and Segs Tsagaanbogd Mountain. We estimated the entire area surveyed at 2,000 km² (assuming a 2.5 km observation distance) and the density estimate for this area was 0.0005 animal/1000 ha (MAINJARGAL & ENKHBILEG 2002).

In September 2002 60 khulans in 1 groups were recorded near West and East Sharga and Bogts tsagaan ders water points and Atas Inges Mountain along 700 km route. Assuming an observation distance 2 km and searched an estimated 2800 km² of the khulan range (LKHAMSUREN 2002). The density estimate was 1 animal/1,000 ha (ASSESSMENT METHOD OF KHULAN 2003).

During a survey in August 2003 we recorded a total of 47 khulans in 18 groups along a 1,500 km route and survey covered 9000 km² (assuming 3 km observation distance) area. This survey was specifically conducted to assess khulan population number in the Trans-Altai Gobi. For 23 individuals we were able to classify the sex and age: 15 stallions, 4 mares and 4 foals. The herd size ranged from 1-6 individuals. Our density estimate was 0.1 animal/1,000 ha (AMGALAN et al. 2003).

In April 2004, researchers recorded 60 khulans in 10 groups along a 2000 km survey route. The total area covered was therefore 13580 km² of khulan range during wild camel survey in Trans-Altai Gobi. Estimated density was 0.02 animals/1,000 ha (ADIYA et al. 2004)

At the end of August and beginning of September 2004, 43 khulans in 12 groups were recorded along 2300 km survey route. Therefore, survey covered 10000 km² of khulan range in Trans-Altai Gobi. A researcher's density estimate was 0.004 animals/1,000 ha (ADIYA et al 2004)

During a survey in February 2005 we recorded 23 khulans in 5 groups along a 469 km route from the eastern to the western part of the Great Gobi A SPA. Assuming a 1.5 km observation distance, we covered 1,408 km² of khulan range. During this survey, khulans were mainly observed in the east and central part of the park, especially in valleys among of high mountains and small hills. Our density estimate was 0.2-0.3 animals/1,000 ha (DORJRAA et al. 2005).

The last survey was conducted in March & April 2005 along a 442 km route, covering 3536 km² of khulan range (assuming a 4 km observation range). Contrary to previous surveys, this survey was not conducted by jeep, but rather by camel. Due to the slower travelling speed and lack of vehicle noise, we expected to have a higher probability of seeing khulan and other wildlife. We recorded 76 khulans in 15 groups. Herd size varied from 1-15. Most khulans were recorded in the southern part of the Atas Inges Mountain. In this area we saw 59 khulans in 3 groups (75 % of all khulan we had seen during the survey) near the Tsagaan tolgoi water point. Estimated density was 0.3 animals/1,000ha (ENKHBILEG et al. 2005).

One important result of the last two surveys was that in late winter and early spring khulans seem to mainly select for pastures in the hill country or in valleys of large mountains (fig. 4). These types of habitat probably provide a better shelter against cold weather with strong winds. In addition, these landscapes trap the snow and this additional moisture results in productive pastures where grass is growing well into autumn. Furthermore, water points along the edge of hills and mountains melt earlier and freeze later than in more open habitats.

Discussion

Population trends in the Trans-Altai Gobi

From 1975 until 2005, 25 surveys have been conducted in the Trans-Altai Gobi to assess khulan numbers. Unfortunately, we see several shortcomings.

First, most of the surveys were conducted in the warmer season, mainly in July, August and September. The main reason for this seasonal bias is that: (1) this is the khulan mating season and groups gather in relatively large numbers at the biggest water points, making it easier to count animals and get data on age and sex structure of the population, (2) summer/fall is the time most convenient for travelling. Unfortunately this bias towards summer surveys does not provide a clear picture of year-round distribution of khulans in this region and limits our understanding of the ecological needs of the species.

Second, the survey routes are very similar and mostly cover the same parts of the park. (fig. 1). However, population and density estimates are calculated for a much larger area, most of which has never been surveyed to confirm the extrapolations. Thus population estimates are rather weak and need to be treated with caution.

Thirdly, survey results varied greatly, e.g. herd size variation ranged from 1 to 300 animals and population estimates range from 20 (July 2002, this study) to 1,674±506 animals (aerial survey in 1997, Reading et al. 2001), when only considering data since the 1990s or up to 8,000 animals, when including surveys from the 1970s (BANNIKOV 1975; fig. 2 & fig. 3).

This large variation in population size may have several reasons: (1) different survey routes were driven, which sampled a different subset of the actual population, (2) different sized potential khulan ranges were used for population- and density estimates, (3) natural variation in the population size due to changes in the habitat followed by large scale movements of khulan and/or fluctuations in the population size caused by mortality due to droughts and other natural disasters, and (4) different survey techniques (e.g. aerial surveys, jeep surveys, camel surveys).

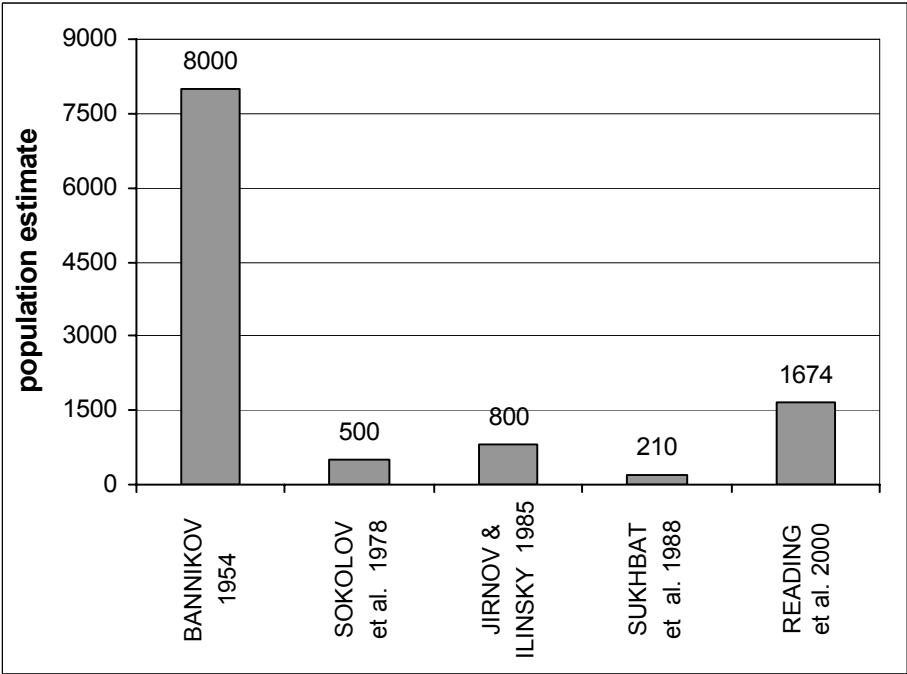


Fig. 2: Estimation of khulans in the Trans-Altai Gobi before March 2000.

At the present time we cannot say with certainty which of the above reasons is playing the key role for the high variation observed. However, it clearly shows how important it is to standardize methods (fig. 3). Otherwise population and density estimates are very unreliable and make it difficult to develop adequate management strategies.

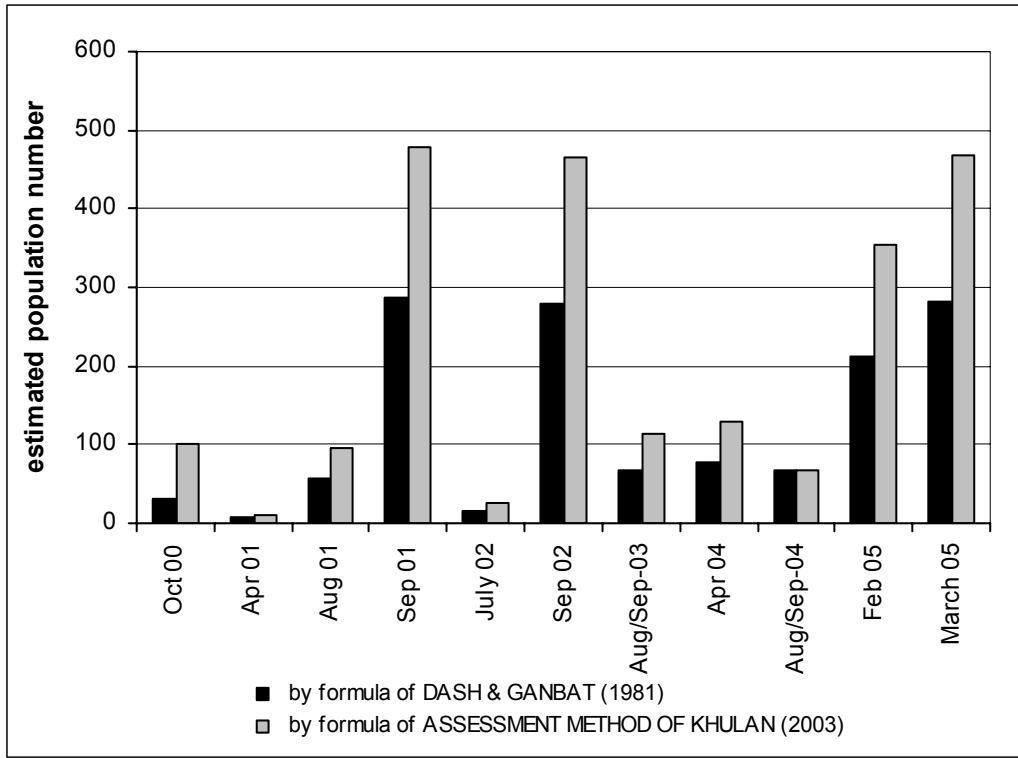


Fig. 3: Estimations of number of khulans in the Trans-Altai Gobi since October 2000 and by two different formulas for population estimation.

Distribution of khulan in the Trans-Altai Gobi

Although quantitative data is somewhat difficult to derive from the surveys conducted in the Trans-Altai Gobi, important qualitative information can be gained. The surveys conducted since 2000 clearly show that khulan do not permanently inhabit the central part of the park, which basically consists of true desert (AMGALAN et al. 2003). Observations confirm that khulan are restricted to areas near the water points south of the Edren Ridge in the north and west and east of Baruun sharga water points in the southern part of the park. However, in April 2001 we did not record a single khulan at the Bogts tsagaan ders, Khukh us and Baruun sharga water points (ENKHBILEG et al. 2002). The survey covered the whole eastern and southern part of the park including the water points Shar khuls, Tsagaan burgas, Zam bilgekh, Khatan suudal and Ekhyn-gol and Zam bilgekh. At all these water points only 1 khulan was seen (at Zam bilgekh) which confirms that khulan presence is not static and supports the idea that khulan make larger scale movements in reaction to local droughts (MAINJARGAL et al. 2001).

In a study carried out in the more productive "B" part of the Great Gobi SPA (FEH et al. 2001) khulans mainly grazed near open water points in summer and in general spent 40.6 % of the year in the desert steppe, 31 % near water points and 23 % in mountain desert (FEH et al. 2001). In the much drier Trans-Altai Gobi, khulan habitat selection is probably even more strongly linked to water availability. It appears that during drought conditions khulans move to the northern parts of the park and only stay in the southern part during wetter years (fig.4 & 5).

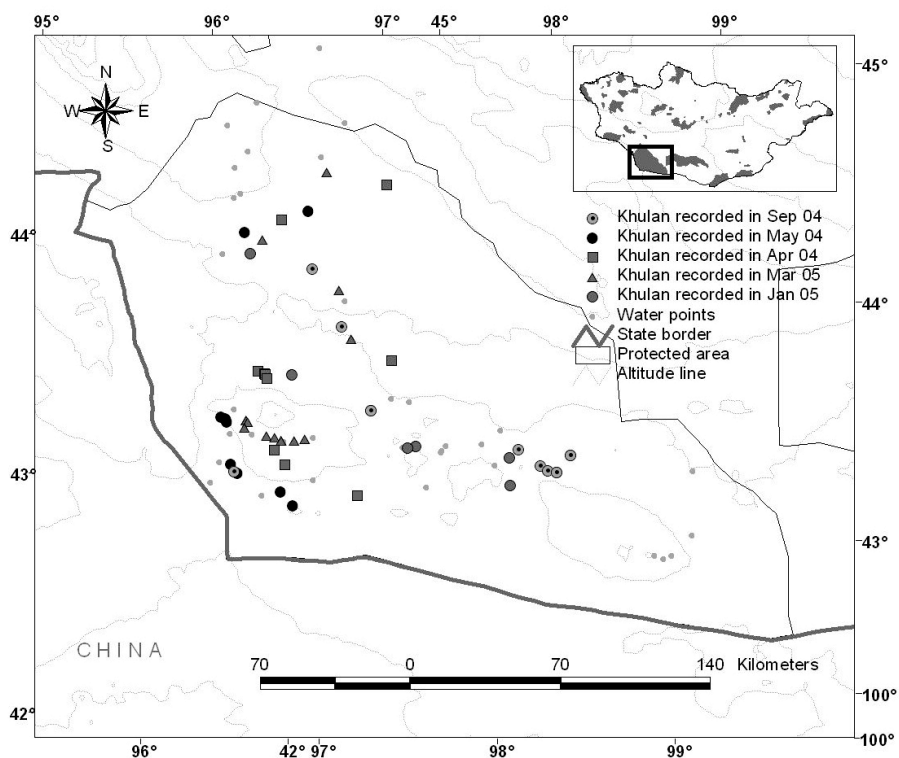


Fig. 4: Khulan habitat selection in the Trans-Altai Gobi during winter and spring (according to ENKHBILEG et al. 2005, DORJRAA et al. 2005, ADIYA et al. 2004).

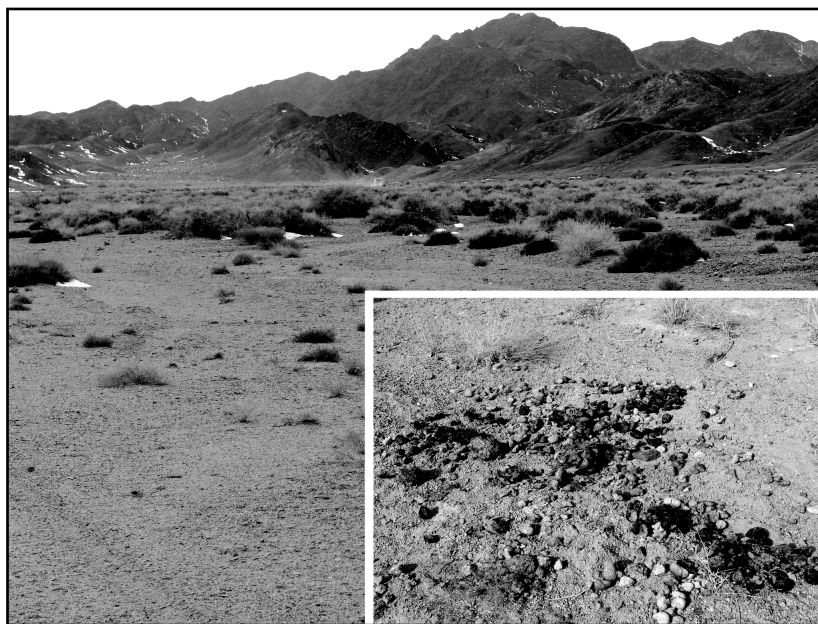


Fig. 5: Khulan favourite habitat during winter and its high density of dung in eastern part of Trans-Altai Gobi (according to DORJRAA et al. 2005, image by D. ENKHBILEG).

Khulans are distributed in 10 out of the 11 ecological regions of the Trans-Altai Gobi. No khulans were recorded in the Baishint eco-region, an area with no water points and no or only very sparse vegetation. Most khulan were recorded near Takhilt, Maikhan and Otgony us water points located in the Shiveetuul- and Otgony us eco-region (JIRNOV & ILINSKY 1985; SUKHBAT & PUREVDORJ 1988). This eco-region is known for its good grass coverage and sufficient water supply. We therefore believe that khulan habitat in the Trans-Altai Gobi is divided into two main parts. The northern part includes Otgan, Maikhan bulag and Takhilgyn us and the southern part includes the areas west and east of Sharga and Atas Mountain range as well as area around Inges (fig. 6). The idea of two population nuclei was already presented by SUKHBAT & PUREVDORJ (1988), however we believe there is a third key khulan area in the southeastern part around Tsagaan bogd Mountain. This later area does not only provide good khulan habitat, but most likely is an important area linking the khulan population in the Trans-Altai Gobi with those in the SE Gobi. During times when the activity of local herders is low, khulan may immigrate from the east towards Tsagaanbogd Mountain as observed during the survey in February 2005 (DORJRAA et al. 2005). We further believe that khulans in the Trans-Altai Gobi show a circular movement pattern from the northern Edren ridge south up to the

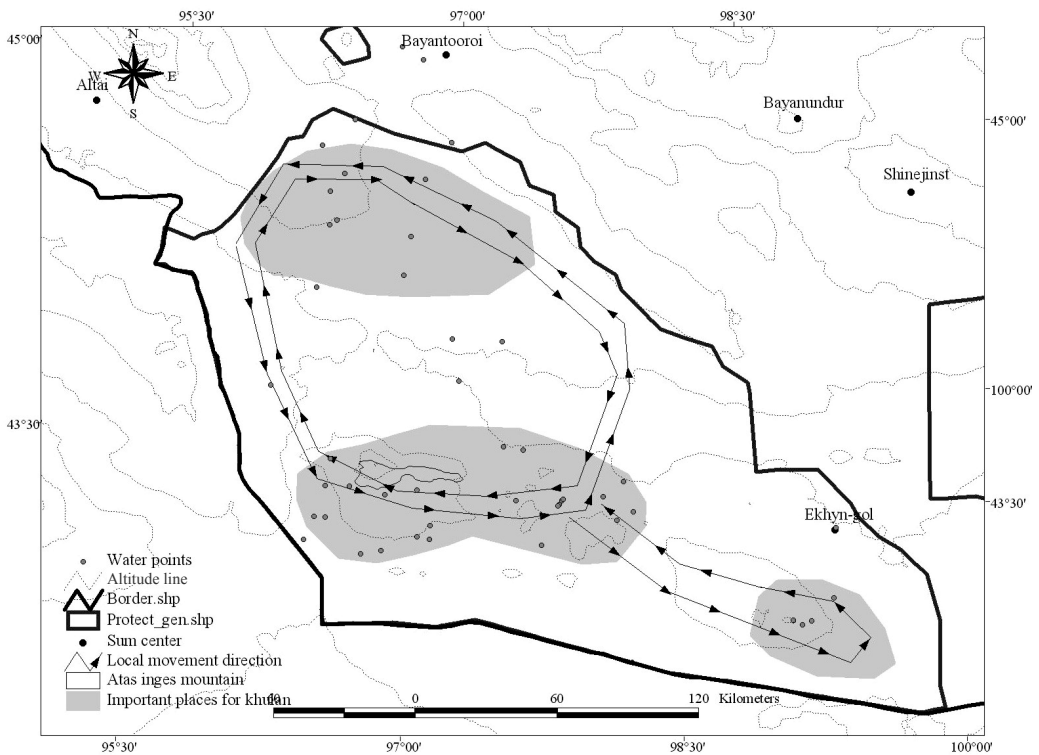


Fig. 6: Main areas inhabited by khulan in the Trans-Altai Gobi and most likely movement directions between these areas.

This south-eastern part of the park is part of the Bayankhongor province. Previous trips into this area did not document khulan presence and researchers came to the conclusion that this area is not suitable for the khulan. However, the survey carried out in January 2005 did document khulan presence (ENKHBILEG et al. 2005) and shows the need to re-evaluate the past assessment of suitable khulan habitat and/or the potential khulan distribution range.

In the past, the potential khulan range was assumed to only cover 16,000-21,700 km² (MIN.NAT. & ENV & INS. BIOL. 2003) and not ~ 41,000 km² as suggested by others (e.g. AMGALAN et al. 2003, READING et al. 2001). Given the geographical features of the Trans-Altai Gobi, we believe the first estimate is much more realistic, because it excludes large stretches of true desert without any water points. The more productive grassland areas in the north are also used by local herders and khulan only seem to cross these areas, but not stay there for extended periods of time (ASSESSMENT METHOD OF KHULAN 2003).

There are very few information khulan population dynamics, namely reproduction and mortality. BANNIKOV (1975), recorded 17 foals among 152 khulans in Trans-Altai Gobi which equals an 11.8 % overall foal rate. Thirty years later, we documented a foal rate of 17% (AMGALAN et al. 2003). In the Great Gobi B SPA or Djungarian Gobi FEH et al. (2001) documented a mean foaling rate of 14.5% (average over 5 years, range 8.6-19.1%). Differences between years were attributed to variations in weather and pasture conditions. Thus, foal rates in the Trans-Altai Gobi do not appear to be particularly low. During the last two surveys (DORJRAA et al. 2005, ENKHBILEG et al. 2005) we did not see any foals in the Trans-Altai Gobi. We have no good explanation for this and can only speculate that either winter mortality was high (we did not find any foal or khulan carcasses) or we somehow missed the groups with foals (encounter rates were small).

Recommendations

The paper showed that a lot still needs to be learnt about khulan in the Trans-Altai Gobi. In summary we would like to recommend the following:

- In-depth ecological studies should be initiated focusing on movement patterns, food selection, habitat selection, and population dynamics (especially reproductive rate, growth and mortality of foals. Preferably khulans should be equipped with satellite collars to: identify movement patterns, food overlap and competition with other large herbivores, influence of weather, influence of human activities, and the like.
- The Park administration closely cooperate with national and foreign scientists/institutions to develop sound and internationally approved survey methods suitable for this very unique ecosystem, conduct joint surveys, and develop conservation strategies for rare species.
- Rangers who live in and around the park need to be trained to conduct regular wildlife surveys. Permanent monthly routes need to be established and monitoring protocols need to be standardized. Ranger patrols are not only good to monitor wildlife populations, but also help to inhibit illegal hunting and other human activities that may negatively impact the park or some of its highly threatened species like the wild Bactrian camel and the Gobi bear.

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